

## APPENDIX B

### NONRADIOACTIVE RELEASES AND ENVIRONMENTAL EFFECTS

Part I of this Appendix (Page B-2) lists amounts of non-radioactive materials released to the environment from plant operations. In addition to the chemicals listed, miscellaneous chemicals are released in small quantities.

Part II (Page B-7) contains historical information on forest management activities.

Part III (Page B-11) discusses the effects of thermal effluents on the Savannah River.

PART I. NONRADIOACTIVE RELEASES  
(for 1975)

1. SEPARATIONS AREAS

a. Releases to Seepage Basins

<i>Cation/ Anion</i>	<i>F-Area Seepage Basins,<sup>a</sup> lb</i>	<i>H-Area Seepage Basins,<sup>b</sup> lb</i>
NH <sub>4</sub>	110	<50
Ca	730	4150
Mg	350	1480
Na	4200	45,400
Fe	2080	1260
Cu	<70	<270
Al	270	3770
Pb	<270	<1100
Zn	680	<2700
CO <sub>3</sub>	0	21,600
OH	0 <sup>c</sup>	0 <sup>c</sup>
Cl	200	3770
Nitrite	30	600
Nitrate	101,000	227,000
SO <sub>4</sub>	3350	10,100
PO <sub>4</sub>	180	28,300
Cr	<270	5100

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a. Based on an average flow of 311,700 gal/week.

b. Based on an average flow of 1,261,000 gal/week.

c. pH of H Area samples ranged from 3.0 to 8.4. The hydroxide concentration at these pH values is too low to detect by routine chemical analysis. The pH of F Area samples ranged from 2.0 to 2.7.

b. Releases to Atmosphere

<i>Chemical</i>	<i>Quantity, lb</i>
Nitrogen	800,000
Freon	1000
Trichloroethylene	8890
Argon	120,000
Hydrogen	1400
Nitrogen dioxide	900,000
Ammonia	20,000
Methane	1200
Helium	2000

2. REACTOR AREAS

a. Releases to Streams

<i>Chemical</i>	<i>Quantity, lb</i>
Sodium chromate	1500
"Polybor"* (as boron)	2000
Sodium phosphate dibasic crystal	300

b. Releases to Atmosphere

<i>Chemical</i>	<i>Quantity</i>
Trichloroethylene	50 lb
(The use of trichloroethylene was discontinued during early 1975 for conversion to perchloroethylene. Operations will be resumed during 1976 with perchloroethylene.)	

3. HEAVY WATER PLANT

a. Releases to Streams

<i>Chemical</i>	<i>Quantity</i>
Silicone (30% solution)	1000 gal
Detergent	4000 lb
Concrete cleaner	1000 lb
Trisodium phosphate	25,000 lb
Phosphoric acid	5000 lb
Potassium permanganate and Manganese dioxide	1500 lb
H <sub>2</sub> S	20,000 lb

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\* Registered tradename of U.S. Borax and Chemical Corp. for Na<sub>2</sub>B<sub>4</sub>O<sub>7</sub>•4H<sub>2</sub>O.

b. Releases to Atmosphere

<i>Chemical</i>	<i>Quantity</i>
Ammonia	2300 lb
"Freon" 12*	3500 lb
H <sub>2</sub> S	94 tons
SO <sub>2</sub>	94 tons

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\* Registered tradename of Du Pont.

4. WATER PURIFICATION CHEMICALS RELEASED TO PLANT STREAMS

<i>Chemical</i>	<i>Thousands of lb</i>
H <sub>2</sub> SO <sub>4</sub> (93.2%)	950
NaOH (50%)	2340
Alum, Dry	250
Alum, Liquid	1050
Lime	150
Chlorine	490
Polyphosphate	8
Sodium sulfite	16
Trisodium phosphate	23

5. FUEL FABRICATION AREA

a. Releases to Streams

<i>Chemical</i>	<i>Quantity, lb</i>
H <sub>3</sub> BO <sub>3</sub>	1250
NiSO <sub>4</sub>	4400
NiCl <sub>2</sub>	580
Methanol	36,000

#### b. Releases to Settling Basins

<i>Chemical</i>	<i>Quantity, lb</i>
NaNO <sub>3</sub>	87,000
NaH <sub>2</sub> PO <sub>4</sub>	22,000
NaCl	240
HNO <sub>3</sub>	52,500
H <sub>3</sub> PO <sub>4</sub>	4100
NaOH	13,000
"Aluminox,"* lime, and "Oakite"***	10,000
NaAlO <sub>2</sub>	48,000
Al(NO <sub>3</sub> ) <sub>3</sub>	4700

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\* Registered tradename of Diversey Corp.

\*\* Registered tradename of Oakite Products, Inc.

#### c. Releases to Atmosphere

<i>Chemical</i>	<i>Quantity, lb</i>
NO <sub>2</sub>	14,000
Perchloroethylene	550,000

### 6. TECHNICAL AREA RELEASES (quantities are estimated from purchases, not measured releases)

#### a. Releases to Streams

<i>Chemical</i>	<i>Quantity, lb</i>
Nitrates	3113
Sulfates	174
Copper	15
Iron	28
Manganese	14
Mercury	1
Phenol	2

b. Releases to Atmosphere

<i>Chemical</i>	<i>Quantity, lb</i>
Trichloroethylene	2320

7. ELECTRICAL AND INSTRUMENT DEPARTMENT SHOPS (Quantity is estimated from purchases, not measured release)

a. Releases to Atmosphere

<i>Chemical</i>	<i>Quantity, lb</i>
Trichloroethylene	1700

8. FUEL BURNING OPERATIONS

a. Releases to Atmosphere

	<i>Area</i>	<i>Quantity, lb</i>
Fly Ash	400-D	21,200,000
	100-C	190,000
	100-K	2,060,000
	100-P	2,000,000
	200-F	420,000
	200-H	390,000
	700-A	270,000
SO <sub>2</sub>	400-D	18,540,000
	100-C	260,000
	100-K	2,140,000
	100-P	2,090,000
	200-F	1,370,000
	200-H	1,320,000
	700-A	830,000
	CMX-TNX (fuel oil)	2000
		<i>Quantity as NO<sub>2</sub>, lbs</i>
NO <sub>x</sub>	400-D	8,600,000
	100-C	170,000
	100-K	1,200,000
	100-P	1,200,000
	200-F	920,000
	200-H	560,000
	700-A	420,000

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a. Calculated based on ideal conditions for oxidation of nitrogen.

b. Release of Ash to Ash Basins

	<i>Area</i>	<i>Quantity, lb</i>
Ash	400-D	57,200,000
	100-C	1,400,000
	100-K	10,940,000
	100-P	10,650,000
	200-F	7,900,000
	200-H	7,550,000
	700-A	4,880,000

PART II. FOREST MANAGEMENT ACTIVITIES  
(for years indicated)

1. TREES PLANTED AND SEEDED ON THE SRP SITE SINCE 1952

<i>FY</i>	<i>Seedlings Planted (thousands)</i>					<i>Acres Planted</i>	<i>Acres Seeded to Longleaf Pine</i>
	<i>Loblolly</i>	<i>Slash</i>	<i>Longleaf</i>	<i>Hardwood</i>	<i>Total</i>		
52-53	9434	327	450	-	10,211	10,470	-
53-54	-	3339	3303	-	6642	6012	-
54-55	543	6658	2608	-	9809	10,287	-
55-56	-	6333	2171	-	8504	10,593	15
56-57	-	8029	1658	-	9687	10,429	-
57-58	411	6908	2959	-	10,278	11,087	-
58-59	-	3911	6794	-	10,705	12,012	-
59-60	-	1722	8076	-	9798	9270	655
60-61	-	-	-	-	-	-	3580
61-62	-	559	-	-	559	510	2914
62-63	-	1031	-	-	1031	1056	4380
63-64	-	697	-	-	697	939	3559
64-65	200	201	16	-	417	490	3025
65-66	23	40	25	-	88	88	130
66-67	4	2	-	-	6	6	2700
67-68	62	90	10	-	162	333	275
68-69	30	95	-	-	125	250	450
69-70	100	140	26	-	266	456	280
70-71	436	-	-	-	436	721	-
71-72	608	-	-	-	608	1130	-
72-73	586	-	-	-	586	968	-
73-74	564	-	50	-	614	1152	-
74-75	391	-	210	16	617	1116	-

## 2. CONTROL BURNS ON SRP

*Calendar Year    Acres Burned*

1952-59	2290
1960	100
1961	350
1962	200
1963	3365
1964	2208
1965	2409
1966	1158
1967	3380
1968	2420
1969	3704
1970	9162
1971	6220
1972	7900
1973	7000
1974	3020
1975	5600

## 3. HERBICIDE AND CHEMICAL TREATMENTS ON SRP BY U.S. FOREST SERVICE

*Calendar Year    Acres Treated*

1954-55	3710
1957	3164
1958	4175
1959	2991
1960	1578
1961	1556
1962	1156
1963	2685
1964	1332
1965	1185
1966	910
1967	900
1968	741
1969	2686
1970	3513
1971	1527
1972	1594
1973	856
1974	380
1975	230



#### 4. TIMBER HARVESTED ON SRP<sup>a</sup>

<i>Cal- endar Year</i>	<i>Saw Timber, thousands of board feet</i>	<i>Pulpwood, standard cords</i>	<i>Total Value</i>
1955	457	99	\$13,318
1956	449	209	12,668
1957	193	721	12,120
1958	3093	2814	139,389
1959	No Timber Cut		
1960	2353	4689	136,998
1961	1721	3126	104,642
1962	3108	16,790	237,100
1963	1591	9988	265,579
1964	1732	37,321	363,734
1965	3378	23,792	295,348
1966	2124	24,208	287,512
1967	1374	26,570	304,050
1968	3061	23,834	305,556
1969	4100	18,498	298,839
1970	4114	24,670	331,480
1971	2024	29,526	297,715
1972	687	33,930	273,675
1973	2025	59,612	565,437
1974	2510	49,599	704,134
1975	830	33,762	538,978

##### a. Method of Harvests (past and present):

Intermediate cuttings - thinnings  
 Regeneration cuttings - shelterwood, seedtree  
 removal  
 Salvage cuttings

## 5. NUMBER OF FOREST FIRES AND TOTAL ACREAGE BURNED

<i>Calendar Year</i>	<i>Number of Fires</i>	<i>Acres Burned</i>
1954	37	3598
1955	16	348
1956	24	392
1957	21	155
1958	42	2060
1959	7	295
1960	16	318
1961	17	165
1962	22	95
1963	12	164
1964	10	17
1965	7	6
1966	11	322
1967	21	187
1968	20	88
1969	28	335
1970	27	20
1971	23	174
1972	32	116
1973	11	16
1974	16	115
1975	11	10

## 6. NUMBER OF FOREST FIRES BY CAUSES

<i>Calendar Year</i>	<i>Lightning</i>	<i>Smoker</i>	<i>Debris Burning</i>	<i>Railroad</i>	<i>Other</i>	<i>Total</i>
1967	2	3	1	11	4	21
1968	4	4	1	6	5	20
1969	3	7	2	11	5	28
1970	4	2	-	20	1	27
1971	2	5	-	14	2	23
1972	-	4	-	19	9	32
1973	-	1	1	6	3	11
1974	6	4	1	4	1	16
1975	2	1	-	5	3	11

### PART III. THERMAL MIXING IN THE SAVANNAH RIVER

Mixing zone measurements were made in April and May 1972 on the Savannah River below the effluents of plant streams that transport heated water discharged from the heavy water plant (Beaver Dam Creek), C Reactor (Four Mile Creek), and K Reactor (discharges into Pen Branch but leaves the swamp through Steel Creek mouth). The river stage was normal (7000 cfs) at the time of the measurements.

Table B-1 shows that in the Beaver Dam Creek outfall the water temperature was less than  $1^{\circ}\text{C}$  above the ambient or unaffected water temperature ( $T_{\text{amb}}$ ) except in the 25% cross-sectional area nearest the SRP side. All measured river temperatures were within  $2.8^{\circ}\text{C}$  of  $T_{\text{amb}}$  by the time the water reached the Four Mile Creek outfall,  $\sim 1.5$  miles below Beaver Dam Creek, as shown in Table B-2.

Tables B-2 and B-3 show that in the Four Mile Creek outfall the effect of the effluent stream on the river is greater than in the Beaver Dam Creek outfall because of higher effluent temperatures and flows. Figure B-1 shows the temperature profile taken at the downstream side of the Four Mile Creek mouth on 4/10/72 (Table B-2). The mixing zone covered 14% of the cross-sectional area, which is within S.C. Water Quality Standards. The size of the mixing zone based on the volume of flow is less than 14% because the hotter effluent water is near the bank where stream velocities are lower than in the middle. Figure B-2 indicates that the mixing zone based on surface area is  $\sim 23\%$  of the total river surface area, which also satisfies S.C. Water Quality Standards. A series of measurements in the Four Mile Creek outfall by the USGS (Table B-3) shows less cross-sectional and surface areas affected by the discharge than those in Table B-2.

Similar measurements made near the Steel Creek mouth (Table B-4) indicate the mixing zones comply with S.C. Water Quality Standards. At the present time, with only K Reactor adding heat to Steel Creek, the mixing zone is smaller than that for the Four Mile Creek outfall because of the much lower effluent temperatures.

River temperature profiles were measured again in June 1974, below Beaver Dam and Four Mile Creek,<sup>1</sup> and confirmed compliance with S.C. Water Quality Standards at both locations.

## REFERENCES FOR APPENDIX B

1. C. Ashley and C. C. Zeigler. *Environmental Monitoring at the Savannah River Plant. Annual Report for 1974.* USAEC Report DPSPU-75-302, Savannah River Plant, E. I. du Pont de Nemours and Co., Aiken, S. C., p 12-17 (1975).

TABLE B-1

River Temperatures Near Beaver Dam Creek  
(Measured 4/10/72)

Location <sup>b</sup>	Depth, ft	Temperatures Above Ambient at Various Distances <sup>a</sup> from Right Bank, °C					Air Temperature, °C
		75%	50%	37%	25%	12%	
I	1	0.1			0.0		22.2
	5	0.0					
	10	0.0					
II	1	0.4	0.1	0.1	1.0	1.7	20.8
	5	0.2	0.1	0.0	1.1	1.5	
	10		0.1	0.0	0.6	1.6	
				0.0	0.4		
				(at 14')	(at 16')		
III	1	0.0	0.0		0.6		22.6
	5	0.0	0.0		0.6		
	10	0.0	0.0		(at 3')		

a. River flow measured at SRP boat docks: 7750 cfs  
 River stage measured at SRP boat docks: 85.9 ft  
 River ambient temperature measured at Location I: 12.8°C

b. Locations:

- I - Control, on Savannah River, 200 yards above Beaver Dam Creek mouth
- II - On Savannah River, at downstream side of Beaver Dam Creek mouth
- III - On Savannah River, approximately one mile below Beaver Dam Creek mouth

c. % of distance across stream from right bank, facing upstream.

TABLE B-2

River Temperatures Near Four Mile Creek  
(Measured 4/10/72)

Location <sup>b</sup>	Depth, ft	Temperatures Above Ambient at Various Distances <sup>c</sup> from Right Bank, °C					Air Temperature, °C
		75%	50%	37%	25%	12%	
I	1	0.1	0.0		0.2		18.4
	5	0.0	0.0		0.2		
	10	0.0	0.0		0.2		
			(at 9.5')		(at 10.5')		
II	1	0.1	0.2	0.7	7.8	13.8	
	2	0.1	0.2	0.6	5.8	13.9	
	3	0.1	0.2	0.6	3.4	14.0	
	5	0.0	0.2	0.6	1.0	14.0	
	8	0.0	0.2	0.6	0.9	(at 3.5')	
	10	0.0		0.5	0.8		
				(at 9.5')	(at 9.5')		
III	1	0.0	0.2	0.3	2.9	3.9	
	2	0.1	0.1	0.5	2.4	2.8	
	3	0.1	0.1	0.5	2.0	2.3	
	5	0.0	0.1	0.5	0.9	1.8	
		0.0	0.1	1.0	0.9	1.6	
		(at 11')	(at 9')	(at 8')	(at 7.5')	(at 8.5')	
IV	1	0.6		0.9	1.4	1.4	
	3	0.5		0.8	0.9	1.4	
	5	0.4		0.9	(at 2.5')		

- a. River flow measured at SRP boat docks: 7750 cfs  
 River stage measured at SRP boat docks: 85.9 ft  
 River ambient temperature measured at Location I: 14.6°C

b. Locations:

- I - Control, on Savannah River, 200 yards above Four Mile Creek mouth  
 II - On Savannah River, at downstream side of Four Mile Creek mouth  
 III - On Savannah River, 100 yards below Location II  
 IV - On Savannah River, 0.5 mile below Location III

- c. % of distance across stream from right bank,  
 facing upstream.

TABLE B-3

River Temperatures Near Four Mile Creek  
(Measured 5/12/72 by USGS)

Location <sup>b</sup>	Depth, ft	Temperatures Above Ambient at Various Distances <sup>c</sup> from Right Bank, °C						
		75%	50%	37%	25%	18%	12%	6%
I	1	0.0	0.0	0.2	0.2	9.6	12.6	
	2				0.2	5.5	6.3	
	4		0.0	0.1	0.2	2.7	3.0	
	6	0.0		0.2	0.2	0.6	0.9	
	Bottom	0.0 (at 12.5')	0.0 (at 8.2')	0.2 (at 6.8')	0.2 (at 7.3')	0.3 (at 9.1')	0.3 (at 7.7')	11.8 (at 2.7')
II	1	0.0	0.2	1.4	2.8	2.8	2.7	2.1
	2		0.2	1.4	2.2	2.3	2.5	2.1
	4	0.0	0.2	1.0	1.7	1.9	2.1	
	6	0.0	0.2	0.5	1.7	1.7	2.0	
	Bottom	0.0 (at 10.4')	0.2 (at 7.4')	0.5 (at 7.4')	1.5 (at 8.1')	1.6 (at 8.0')	1.9 (at 9.2')	2.0 (at 5.8')
III	1	0.6	1.1	1.0	0.6	0.6		
	4			0.8	0.6	0.5		
	6	0.6	1.0	0.8	0.6	0.6		
	Bottom	0.4 (at 12.4')	0.4 (at 16.8')	0.2 (at 19.6')	0.4 (at 24.1')	0.4 (at 17.2')		
		1	0.6	0.7		0.8		0.8
	Bottom	0.6 (at 11.6')	0.7 (at 10.7')		0.8 (at 12.0')		0.5 (at 12.1')	

a. River flow measured at SRP boat docks: 7000 cfs  
River stage measured at SRP boat docks: 84.9 ft  
River ambient temperature measured above creek mouth: 18.6°C

b. Locations:

I - On Savannah River, 50 ft below Four Mile Creek, at USGS mile 150.65  
II - On Savannah River, ~700 ft below Four Mile Creek, at USGS mile 150.53  
III - On Savannah River, ~0.5 mile below Four Mile Creek, at USGS mile 150.1

c. % of distance across stream from right bank,  
facing upstream.

TABLE B-4

River Temperatures Near Steel Creek Mouth  
(Measured 4/13/72)

Location <sup>b</sup>	Depth, ft	Temperatures Above Ambient at Various Distances <sup>c</sup> from River Bank, °C					Air Temperature, °C
		25%	50%	37%	25%	12%	
I	1	0.0	0.0		0.0		27.8
	5	0.0	0.0		0.0		
	10	0.0	0.0		0.0		
		0.0			0.0		
		(at 11.5')			(at 11')		
II	1	0.2	0.0	0.0	0.0	2.4	28.6
	2	0.2	0.0	0.0	1.2	3.0	
	3	0.1	0.0	0.0	1.1	3.0	
	5	0.1	0.0	0.0	1.1	1.4	
	10	0.1	0.0	0.0	0.3	1.1	
		(at 7')	(at 10.5')	0.0	0.1	0.4	
III	1	0.1	0.0	0.0	0.1	0.9	30.0
	2	0.1	0.0	0.0	0.0	1.2	
	3	0.1	0.0	0.0	1.1	1.2	
	5	0.0	0.0	0.0	0.1	1.1	
	10	0.0	0.0	0.0	0.1	0.8	
			(at 9.5')	0.0	0.1	0.8	
IV	1	0.4	0.1	0.2	0.5	0.9	
	5	0.2	0.1	0.2	0.5	0.8	
		0.2	0.1	0.2	0.5	0.9	
		(at 7')	(at 8')	(at 8.5')	(at 10.5')	(at 12.6')	
V	1	0.5	0.6		0.7		28.9
	5	0.4	0.6		0.7		
	10	0.3	0.5		0.7		
		0.3	0.3		0.7		
		(at 23')	(at 20')		(at 13')		
VI	1	0.6	0.5		0.5		29.0
	5	0.5	0.4		0.5		
	10	0.5	0.4		0.5		
		0.5	0.4		0.5		
		(at 11')	(at 14')		(at 15.5')		

a. River flow measured at SRP boat docks: 7450 cfs  
River stage measured at SRP boat docks: 85.5 ft  
River ambient temperature measured at Location I: 16.9°C

b. Locations:

- I - Control, on Savannah River, above Steel Creek mouth
- II - On Savannah River, 20 ft below Steel Creek
- III - On Savannah River, 100 yards below Steel Creek
- IV - On Savannah River, 0.6 mile below Steel Creek
- V - On Savannah River, one mile below Location IV
- VI - On Savannah River, one mile below Location V

c. % of distance across stream from right bank,  
facing upstream.



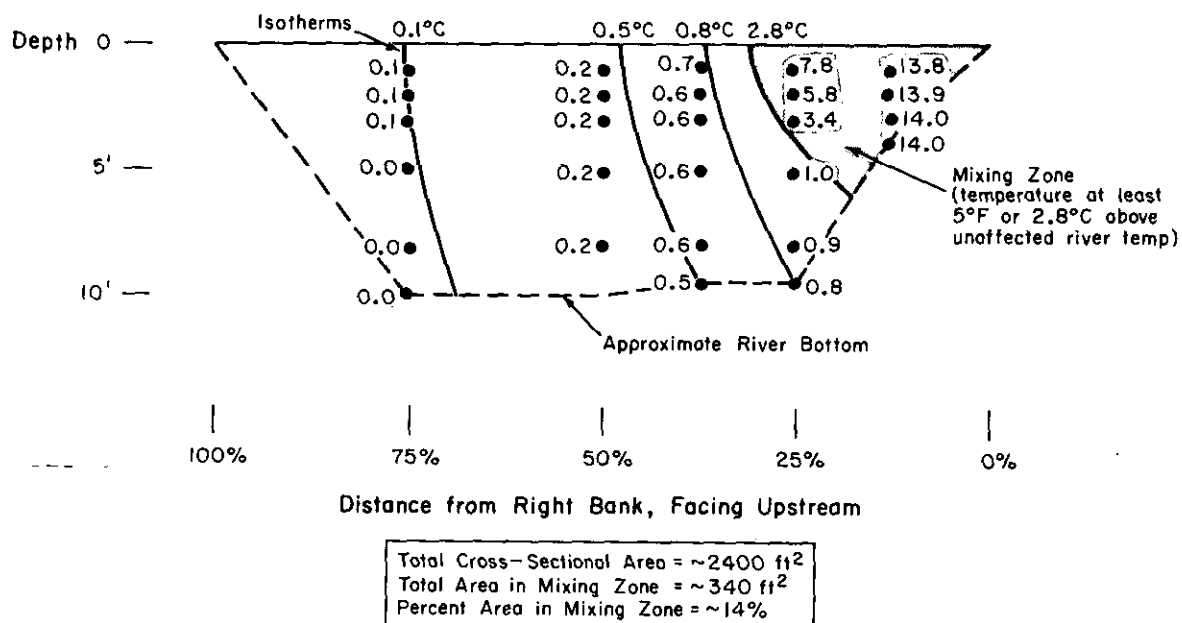
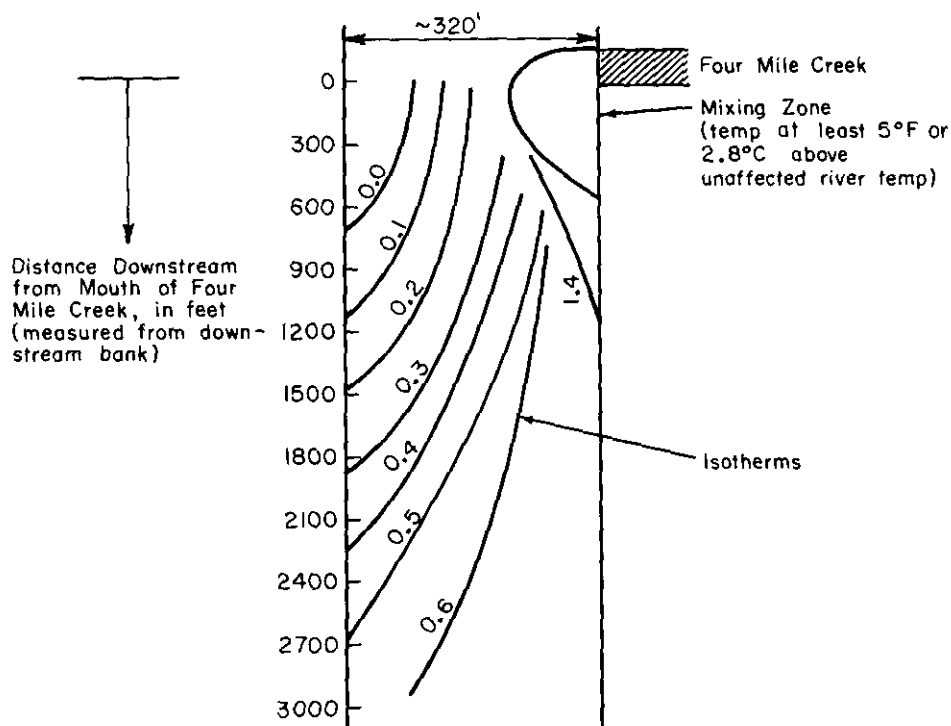


FIGURE B-1. Temperature Cross Section at Downstream Side of  
Four Mile Creek Mouth  
Temperatures Given in °C Above Unaffected River Temperature



- Total Surface Area in Reach of River Affected by Mixing Zone (450 ft upstream to 540 ft downstream of downstream bank) = 210,000 ft<sup>2</sup>
- Surface Area in Mixing Zone = 48,000 ft<sup>2</sup>
- Percent Surface Area in Mixing Zone = 23%

FIGURE B-2. Surface Temperatures Downstream of Four Mile Creek Mouth  
Temperatures Given in °C Above Unaffected River Temperature